osteoporotic hip fractures can be prevented and the doses of estrogens necessary to prevent postmenopausal osteoporosis are small and safe. We hear a lot about public health and geriatric medicine, and their ever-increasing costs. One of the few catastrophes of old age that can be prevented is hip fracture. If osteoporotic hip fractures, which constitute the bulk of the problem, can be prevented (and the evidence is that they can be) with a prophylaxis that is cheap and safe, then why not prevent them?

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Magnesium

AMONG CATIONS of biologic importance, magnesium is the forgotten member. It is the predominant divalent cation within cells and, hence, can hardly be classified among the "trace elements," as it oftentimes is. What is implied by this assumption is that our appreciation of the role of magnesium in biologic processes is undeservedly limited.

To place the role of magnesium in biologic processes in proper perspective, it might be helpful to recall that magnesium has played an important role in the evolutionary process ever since the planet earth appeared about 4.6 billion years ago. The predominant mineral of the earth's mantle, as it cooled, was olivine ($[Mg,Fe]_2SiO_4$), which by erosion served as a plentiful source of ionic magnesium to soil and water. Magnesium probably participated in the inorganic condensation reactions which eventually resulted in the appearance of organic compounds from whence arose anaerobic bacteria, the first form of life. (The atmosphere of the earth intially was without oxygen.)

There followed the evolution of chlorophyll, with magnesium as its central atom, and green plants appeared, transforming the atmosphere to contain oxygen, even as solar energy was captured by the chlorophyll for the synthesis of carbohydrate. The ubiquitous adenosine triphosphate (ATP) evolved as the storehouse of chemical bond energy; wherever there is ATP, there is an obligatory need for magnesium in the biologic machinery. As the biochemical mechanisms improved in efficiency and as oxidative phosphorylation evolved, aerobic bacteria and multicellular plants appeared, followed by animals. Protein synthesis requiring the involvement of ribonucleic acid (RNA) and the genetic mechanism involving deoxyribonucleic acid (DNA) both have an obligatory need for magnesium.

From an evolutionary standpoint, therefore, magnesium deficiency can develop in plants when the soil content of this mineral is depleted by weathering and is not corrected by replacement. In animals feeding on plants with magnesium depletion the same deficiency may develop; such a deficiency is recognized in cattle as grass staggers. The clinical syndrome in humans may be conditioned by not only a magnesium-deficient diet, but by other factors such as the availability

of absorbable magnesium in the diet and the additional need for magnesium during stress, as during pregnancy, lactation, or greater growth rate in children.

Elsewhere in this issue, Dr. Flink has expertly reviewed the clinical manifestations of magnesium deficiency in animals and in humans. Clinically, magnesium deficiency is manifest in disease states primarily because of either interruption of food intake or intestinal or renal loss of the mineral. In chronic alcoholic patients magnesium deficiency may develop because of an unbalanced diet and caloric dependence on alcohol. Children with protein-calorie malnutrition (kwashiorkor) may have accompanying magnesium deficiency, which can be corrected by magnesium supplementation, as has been reported in the now classic studies by Caddell.[1] More intriguing is the possibility of marginal dietary magnesium intake and minimal magnesium content in drinking water being correlated with a high incidence of hypertension or coronary artery disease, and the possible relationship of subclinical magnesium deficiency to increased incidence of cardiac arrhythmia. Hard drinking water may be protective.

An empirical but rational load test is now available to detect the presence of magnesium deficiency. It should be used more frequently, because the test is simple to carry out, is almost risk-free (except in the presence of severe renal failure) and is relatively inexpensive.

In the event that magnesium deficiency is suspect, a therapeutic trial of supplemental magnesium may be in order. Again, the risks are minimal.

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